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use of falsetto in
the male voice.

UNIVERSITY OF ALBERTA

THE DEVELOPMENT AND USE OF FALSETTO IN THE MALE VOICE

BY

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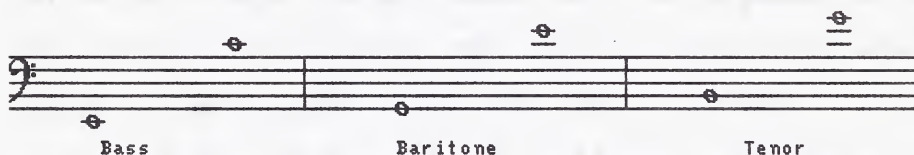
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The use of *false* singing dates back to around thirteenth-century Europe. During this time, women were not allowed to sing in church choirs and therefore male *false*tists sang the alto part of choral works while young boys performed the soprano line. During the latter part of the sixteenth century the soprano line was sung by both *castrati* and boy sopranos. In the nineteenth century, women began to participate in Protestant Church choirs, thus making it no longer necessary to have males sing the alto and soprano parts (Garretson 1983, 5-6). However, although the need for *false* singing has fallen away, composers and singers continue to explore the possibilities of the *false* range. *False* singing is still practised in English cathedral choirs and collegiate choirs (Negus and Jander 1980, 375). Several twentieth-century composers, including Tippett, Britten, and Millers, have composed for the male *false* voice (Giles 1982, 138). With the current interest in authentic performance practice (which includes historical vocal production) scholars, conductors, and vocalists are increasing their knowledge and understanding of *false* production (NATS 1985, 41:9).

False singing is a matter of significant importance not only to all male singers, but also to all voice teachers. This document will examine the physiological aspects of *false* production, suitable techniques for development of the *false* register, and the use of *false* register in contemporary compositions.

At some point during the nineteenth century voices began to be classified into six fundamental categories, three of which were male, three female. The three men's voice classifications were bass, baritone, and tenor. Each of these male voice types possesses a normal, or full, voice range (The New Harvard 1986, 926):



Occurring above the normal or full voice range is the falsetto range, a phenomenon confined primarily to the male voice.

In order to understand the mechanical action of the larynx in falsetto production, it is essential to discuss the intrinsic cartilages and musculature of the larynx and their functions in normal voice production. Even though the larynx consists of three single cartilages and three paired cartilages which are interconnected by ligaments and membranes and actuated by various intrinsic muscles (Miller 1986, 242), this document will focus on only the primary cartilages, muscles and joints of the larynx that are involved in phonation.

The larynx is positioned at the uppermost end of the trachea. The two primary single cartilages of note are the cricoid cartilage and the thyroid cartilage. The cricoid

cartilage, a ring-shaped structure, is the lowest-most member of the three single cartilages. "It is located below the thyroid cartilage and articulates with the inferior cornus of the thyroid cartilage."¹ Because it is the largest cartilage, the thyroid cartilage forms most of the anterior and lateral walls of the larynx. Of the three paired cartilages the main ones involved in phonation are the arytenoid cartilages. The base of these cartilages, two paired pyramid-shaped structures located on the superior border of the cricoid cartilage, articulate and swing freely in a lateral direction at the cricoarytenoid joint. "Each cartilage has three points -- an apex, a muscular process, and a vocal process."² Attached to the vocal process of the arytenoid cartilages is the posterior portion of the vocal ligament (Romanes 1986, 157-160; Singh 1980, 111-113). Singh outlines the importance of this articulation:

Movement at this joint causes the thyroid cartilage to swing downward or upward, much like the visor on a knight's helmet. This causes tension on the vocal ligament to be increased or decreased.³

There are extrinsic and intrinsic laryngeal membranes connecting the cartilages to each other. The vocal ligaments, or vocal cords, are part of the intrinsic laryngeal membrane known as the cricovocal membrane, or the conus elasticus (Singh 1980, 114-116). The conus elasticus originates on the right and left superior margins of the cricoid cartilage and runs in a medio-superior direction. The thin

superior borders form the vocal ligaments which are joined anteriorly to the thyroid cartilage and posteriorly to the vocal process of the arytenoid cartilage. Between the two vocal ligaments is a space known as the rima glottidis, or glottis.

The intrinsic muscles of the larynx affect the adduction, abduction, tension, and relaxation of the vocal ligaments. There are three primary muscles of adduction, or cordal closure: these include the transverse and the oblique arytenoid, which bring the arytenoid cartilages together, thereby closing the rima glottidis, and the lateral cricoarytenoid, which causes the rima glottidis to close by rotating the arytenoid cartilages to a medial position. The rotation is accomplished through the anteriorly directed action exerted on the muscular process of the arytenoid cartilages (Singh 1980, 119; Romanes 1986, 165-166).

Abduction, or separation, of the vocal ligaments is accomplished through the action of one muscle: the posterior cricoarytenoid. The superior horizontal fibers cause the vocal process of the arytenoid cartilage to swing in a lateral direction which opens the rima glottidis. Further increase in the size of the rima results when lateral force is exerted on the arytenoid by the inferior vertical fibers of the posterior cricoarytenoid (Romanes 1986, 165; Singh 1980, 119).

Laryngeal vocal ligaments are tensed, or elongated, by the cricothyroid muscle. This muscle, which consists of the pars recta and pars obliqua, is inserted on the caudal

margin and inferior cornu of the thyroid cartilage (Figge 1977, 2:160). Its origin is located on the anterior and lateral lamina of the cricoid cartilage (Singh 1980, 119; Figge 1977, 2:160). As the cricothyroid muscle pulls the thyroid cartilage in a posterior direction, the vocal ligaments are elongated and tightened; this muscle action causes the pitch to be raised. When singing high notes in the fundamental register, a portion of the vocal ligaments are tightened by muscle fibers adjoining the inferior-lateral surface of the vocal ligament. This muscle is called the internal thyroarytenoid, or vocalis muscle (Singh 1980, 119; Miller 1986, 252). In his book, *The Science of Vocal Pedagogy*, Ralph Appelman mentions that:

[the vocalis fibers] perform the refined tasks of controlling the conformation of the vocal fold in its various states of thickness and thinness during changes in pitch.⁴

Relaxation of the vocal folds is the result of the external thyroarytenoid muscle action. For the singing of notes in the lower vocal register, this muscle pulls the arytenoids in an anterior direction, which shortens, and therefore relaxes, the vocal ligaments (Miller 1986, 253; Romanes 1986, 166).

Miller describes the vocal folds as being a combination of "mucous membrane, submucosal layer, the elastic vocal ligament, and the vocalis muscle."⁵ Titze states that the vocal folds, consisting of a body, which is the vocalis muscle, and a cover, which is the ligament and mucosa, also comprises both active and passive tissue. Fundamental

frequency is controlled by the elastic properties of the vocal folds. A high degree of flexibility in fundamental frequency control is a result of the passive or active tissue state of the vocal folds (Titze 1981, 30; Miller 1986, 256-7). Miller mentions that correct vocal production:

is largely dependent . . . on balanced interaction among the intrinsic laryngeal muscles and vocal-fold tissues in response to the demands of pitch, volume, and phonetic timbres, and to the application of appropriate subglottic pressure and airflow.⁶

Pitch is increased by the stretching, or elongation of the vocal folds and vocalis muscle. Meribeth Bunch succinctly describes the elongation process:

The crico-thyroid muscles pull the thyroid cartilage forward and tilt the cricoid cartilage backward, thus elongating the vocal ligaments and increasing tension.⁷

As the folds become stretched, they also become thinner which increases their vibrating frequency, thus producing a higher pitch. At the maximum elongation point of both the vocal folds and vocalis muscle in the normal register, the higher pitches of the *falsetto* range are produced.

As the voice ascends into the *falsetto* register, that part of the vocal range in which the highest pitches are produced, the vocal folds and thyroarytenoid muscles behave in a peculiar manner. With high-speed cinematography, it can be seen that during normal modal or fundamental register production, and through the transition point from modal to

false register, the entire mass of the vocal folds vibrates fully. The cords are fully extended and complete closure is noted along the entire length of the cords. The glottal opening elongates considerably during pitch ascension through the fundamental registers, however no lengthening occurs in the transition point to *false* register. Furthermore, little or no lengthening is observable in *false* production. For a brief moment, at the register "break" from modal register to *false* register, the movements of the cords become irregular and somewhat chaotic. As the *false* register is entered, the cordal movements become less tumultuous. The thin edges of the cords contact each other intermittently while the lateral thyroarytenoid muscles are inactive and nonvibratory (Rubin and Hirt 1960, 1308-9, 1311).

A characteristic of *false* production is a thinner quality of sound, caused by changes in the intrinsic muscles and vocal folds. During pitch ascension, the cricothyroids contract and bring the vocal cords to their maximum state of tension. In order to further raise the pitch into the *false* register, the thyroarytenoids must assume a state of partial contraction. It is this partially contracted state of the thyroarytenoids which distinguishes the *false* register from the fundamental register. During phonation, air passing through the vocal cords causes only a small amount of the thyroarytenoids to vibrate while they are in this condition. Henry Rubin and Charles Hirt explain that:

by maintaining a high degree of tension in the medial marginal fibers of the thyroarytenoids and by relative relaxation of the main muscular mass so as to avoid its directly confronting the air blast, the higher pitch and thinner quality of the falsetto are produced.⁸

At this point only the margins of the vocal folds vibrate. Impartial closure of the folds occurs because resistance to subglottic air pressure is greatly reduced and the thin cordal margins are blown apart during each vibratory excursion, which in turn prevents proper cordal adduction. In these ways the characteristic sound of falsetto is produced (Rubin and Hirt 1960, 1311).

As well as muscle changes, the vibratory patterns of the vocal folds have an effect on the falsetto register. There are three primary patterns of vibratory activity: open-chink, closed-chink, and stop-closure or damping. Open-chink activity involves either occasional cordal contact or a complete absence of cordal contact during falsetto singing. In this type of activity thyroarytenoid muscle mass activity is significantly reduced, almost to the point of total relaxation, and only the thin cordal margins are set into vibration by a diminished amount of subglottic air pressure. This type of cordal activity occurs throughout the entire falsetto register in some singers. Sometimes an anterior to posterior cordal rolling movement is observed: as the posterior portion of the cords abduct, the anterior portion adducts (Rubin and Hirt 1960, 1312).

In the closed-chink vibratory pattern of falsetto singing, the primary muscle activity occurs in the medial

fibers of the thyroarytenoids, with the main muscle mass becoming less active than in fundamental register vocalization. In this type of vibratory pattern, vocal fold closure is the same as in full-voice phonation. Contact of the vocal cords occurs for only a brief moment, the cords appearing to spring apart after initial contact (Rubin and Hirt 1960, 1314).

Although the *false* sound appears to be thinner than that of a full voice sound, a wide range of vocal dynamics can be produced. During *fortissimo false* singing, the cords are pushed apart with such great intensity that they spring back together. As the dynamic volume lessens, some of the cordal vibrations exhibit characteristics of the open-chink vibratory patterns (Rubin and Hirt 1960, 1314).

When alternation of the open-chink and closed-chink vibratory patterns produces a single sound, the maximum state of balance has been reached between cordal margin tension and subglottic air pressure. In this balanced state, the subglottic air stream forcefully separates the cords; however, the extremely high frequency of cordal vibration causes the margins to contract towards a medial position without ever touching. They remain separated until a further increase in air pressure blows them apart again. An absence of close cordal approximation during this phase means that less air pressure is required to initiate lateral movement. As a result, a significant amount of air pressure is lost at this point, permitting cordal contact in the

medial position again (Rubin and Hirt 1960, 1314-15).

Stop-closure or damping is the third type of cordal vibratory action. This process is observed less often than the two aforementioned mechanisms and is noticed mainly in those male singers who possess advanced skill in falsetto register production. It occurs at the highest end of the falsetto register and enables the singer to obtain higher pitches than the other two vibratory patterns allow. In this type of action, progressive vocal occlusion occurs in a posterior to anterior direction. The pitch is increased as the glottal opening is shortened, and as the glottal opening is diminished to its smallest size, only a squeak is audible. Beyond this squeaking stage, the larynx closes spasmodically (Rubin and Hirt 1960, 1316-18).

In damping, the laryngeal resonating chamber contracts to its smallest size and the epiglottis is drawn over the larynx in a covering position. An increase in pitch results from the reduction and immobilization of cordal length and mass. The diminution of the lateral diameter of the larynx could be the result of contraction occurring in laterally situated muscles, however at present little is known about this phenomenon (Rubin and Hirt 1960, 1318).

Some pedagogues feel that development of the falsetto register is unnecessary while others warn of the potential danger of developing nodules if the falsetto voice is used to a great extent (Rose 1971; Dunkley 1942; Miller 1986). A significant amount of pedagogical vocal literature, however,

agrees that there is value in developing the *falsetto* register. Three primary areas of benefit are: the development and balancing of intrinsic muscle action, joining the *falsetto* register to the head register, and the development of the head voice. An additional benefit is the development of breath control through the use of *falsetto* register exercises.

There is a considerable amount of muscular activity involved in singing which happens below the level of consciousness and which is beyond the singer's ability to control. For example, the coordinated balance and activity of the intrinsic laryngeal musculature is not an activity that can be manipulated at will by the singer. Certain exercises, however, prove effective in the development of the intricate balance of these muscles during phonation.

Because of the decreased amount of muscle mass involved in *falsetto* singing, vocalization in this register can often appear to be weak and breathy. But as the intrinsic muscles are developed and strengthened, especially the thyroarytenoid and cricothyroid muscles, the *falsetto* register begins to take on characteristics of head tone production (Rubin and Hirt 1960; Hammar 1978, 117-8; Vennard, Hirano, and Ohala 1980, 170-1). Husler and Rodd-Marling describe this type of *falsetto* production as "a tone quality of greater tension, strength and carrying-power."⁹

Volume increase in *falsetto* can be controlled by development of the intrinsic muscle action. In the fundamental

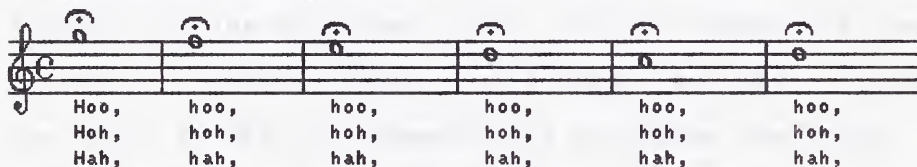
and falsetto register volume is controlled by the force of the subglottic air stream. The air flow in falsetto production is greater than in either chest or head register. Control of the laryngeal muscles allows the vocal cords to remain unaffected by any increase in subglottic air pressure, with only the section of the thyroarytenoid muscles involved in the vibrating action responding by an increased lateral movement rather than the entire muscle mass. This makes it possible to produce a falsetto sound with greater volume (Rubin and Hirt 1960, 1321; Vennard, Hirano, and Ohala 1980, 175).

Changes in pitch in both the falsetto and fundamental register involve changes in vocal fold tension. In the trained singer, the glottal chink is not significantly elongated during pitch ascension; the pitch is raised by selective contractions of the medial thyroarytenoid fibers. In order to develop greater control over intrinsic muscular activity, the singer could use the following *messa di voce* exercise: vocalizing from *piano* to *mezzo forte* in the comfortable part of his falsetto range. As greater control is developed the singer could swell from *pianissimo* to *fortissimo* in his falsetto register (Rubin and Hirt 1960, 1321, 1324).

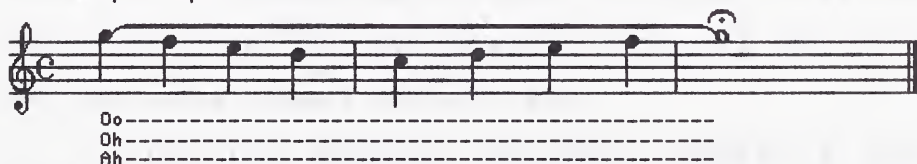
Christy advocates the use of falsetto exercises to strengthen the arytenoid muscles, the development of which is necessary to balance the thyroid muscle action. When this balanced state is achieved, the singer is able to carry the lower register higher without any tension, thus produ-

cing the true head voice (Christy 1974, 156-7). Van Christy cites three basic exercises for falsetto development, which are to be worked from falsetto down. These exercises should be performed with as much support, tonal volume, and intensity as possible, keeping the jaw relaxed and well opened. The main objective of the vocalises is to carry the *falsetto* down as low as possible while striving to increase vocal dynamics and range in this register:

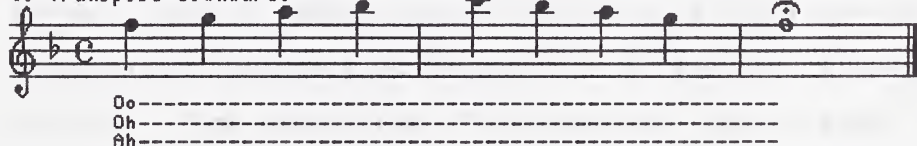
1. Transpose the entire exercise stepwise downward. A breath should be taken after each note.



2. Transpose upward.



3. Transpose downward.



Rubin and Hirt observe that trained singers possess a smooth transition from fundamental to *false* register during the execution of ascending *glissando* scales or *arpeggios*. The absence of a break in the voice while proceeding from fundamental register to *false* register is an indication that intrinsic muscle balance has been attained (Rubin and Hirt 1960, 1319). High-speed photography reveals that:

In well trained singers the voice passes from low fundamental registration to *false* with no abrupt change in quality or appearance of the vocal cords.¹¹

To alleviate the problem of the voice break in *passaggio* singing for the untrained voice, various approaches are possible. Herbert-Caesari talks about the need to lighten the voice in the area immediately preceding the break. Hammar recommends the use of imagery; he encourages the singer to envision a lighter texture as the *passaggio* is approached. The use of visual imagery is believed to help the mind direct the musculature into functioning properly. Most pedagogues agree that the *passaggio* needs to be bridged from the top down. Hammar offers some useful *false* exercises. Although the following exercises lie in the tenor tessitura, they can be adjusted to suit the baritone or bass voice (Hammar 1978,111-115).

In the first exercise, the singer vocalizes at the dynamic level of *mezzo piano*, beginning in the *false* register and progressing downward in a five-note stepwise pattern. Each repetition of this passage should begin one half-step lower until the top note of the scale is middle C.

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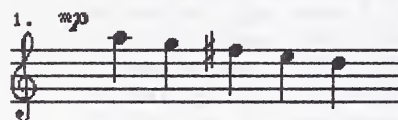
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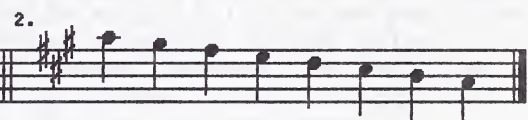
Once the singer is able to perform the five-note scale with considerable ease, he should repeat the aforementioned exercise using the full octave:

1. mp



Mm-----
Oo-----
Ee-----

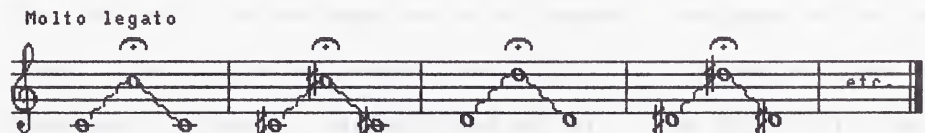
2.



Mm-----
Oo-----
Ee-----

Once the singer has learned to lighten the mechanism as the *passaggio* is crossed, Hammar suggests the use of ascending and descending supported *glissandos* or *portamentos* to help eliminate mass or thickness in the vocal folds, and to help achieve a lighter approximation of the vocal folds as the *passaggio* is approached from below. This will allow the problem area to be crossed smoothly without a noticeable break. This type of exercise should begin about middle C and ascend by semitones until the starting note is B natural. He should pause on the top note to ensure proper tonal focus is attained before beginning the descent. The jaw should be kept relaxed and down at all times:

Molto legato



Ee-----
Oo-----
Ah-----

Ee-----
Oo-----
Ah-----

Ee-----
Oo-----
Ah-----

Ee-----
Oo-----
Ah-----

etc.

Husler and Rodd-Marling conclude that the falsetto register and head register are closely related:

Falsetto and head register are variants, therefore, of one and the same basic element; both qualities are brought about by the functions that stretch the vocal folds with little or no participation from the muscles embedded in the folds themselves. The difference between the two lies chiefly in the shaping of the glottal chink; in falsetto it becomes shorter and narrower.¹²

These authors maintain that the head voice can be developed out of the supported falsetto sound. Exercises performed in the falsetto range strengthen the cricothyroids and help the vocalis muscle to relax. This development promotes head tone production. For proper head tone production, the cricothyroids must be very strong, even stronger than in high falsetto production, while the vocalis must moderately relax. If the latter muscle relaxes too much the voice breaks into falsetto.

The falsetto voice must be focused far forward in the mask and have a warm and open quality. A weak falsetto sound can eventually become stronger and more intense through the use of forward placement and through proper breath control (Husler and Rodd-Marling 1965, 59; Vennard, Hirano, and Ohala 1980, 170-1). A thin, breathy quality in the falsetto voice denotes a collapsed, unsupported mechanism. This type of production leads to a cracked tone and involves a greater expenditure of air than the efficient, open, and well focused falsetto voice. If the musculature involved in falsetto production is not adequately developed then overblowing in the *passaggio* region may cause the

entire vocalis muscle mass to vibrate; the voice will then drop into the lower register. Intrinsic muscle strength must be developed so that the vocal cords will be able to withstand any increase in subglottic air pressure. The singer will be able to use his breath efficiently in the falsetto register if the musculature is developed properly. Execution of *messa di voce*, the gradual *crescendo* and *decrescendo* of a sustained pitch, in the falsetto register will be possible when both a state of balanced muscle development and breath control is achieved (Hammar 1978, 119-20; Husler and Rodd-Marling 1965, 59; Rubin and Hirt 1960, 1321).

The use of falsetto as a pedagogical tool for developing the voice remains a much-discussed issue among voice teachers today. In an interview with Harold Wiens, this voice professor at the University of Alberta talked about his own use of the falsetto register as a teacher and performer as well as the use of falsetto by his mentor, Theo Lindenbaum from the North West German Music Academy in Detmold Germany (Harold Wiens, 28 February 1992).

Lindenbaum, a student of Frederick Husler, used the falsetto register extensively. His objective was to develop the falsetto voice to the point where it would bridge over into the normal voice. He claimed that this was an ideal which could be achieved. This ability to switch from normal to falsetto register freely would indicate that the student possessed a healthy voice and good vocal control. Lindenbaum felt that a healthy voice should have falsetto as part

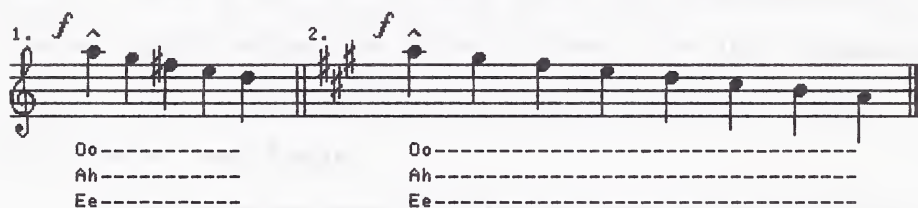
of the regular tone; therefore, he used the term middle voice to describe a mixture of *false* and normal voice. Pure *false* voice or pure chest voice would be hypothetical concepts. This pedagogue would have his students oscillate, or make a pure transition, from *false* to normal voice several times while sustaining a given note. This exercise was used to help bridge the gap between the *false* and fundamental registers.

Harold Wiens uses *false* as a means to develop ease of production in the main voice. He believes that the *false* should be developed to the point where it is close in nature to the regular voice. *False* singing should possess support, strength, openness, and placement. There should be ease of production and uniform quality throughout the *false* range. An undeveloped *false* with a breathy or pinched tone, lack of strength and limited range may indicate a collapsed mechanism.

Professor Wiens tries to bring the student's *false* down as low as possible. This helps in the development of uniform placement and resonance throughout the vocal range. Once achieved, such vocalization with proper breath support, openness of production, tonal focus, and placement throughout the entire range results in the vocal mechanism being well coordinated with the registers being blended together smoothly. Professor Wiens notices a different, more efficient type of support in his own vocalizing as he brings the *false* down in the aforementioned manner.

The following exercise is one which Professor Wiens

uses both to develop efficiency in the mechanical actions of the falsetto voice and to bring this action down into the normal vocal range so that vocal production in the normal voice becomes easier. Not only will the range of the falsetto register be extended through the use of this exercise, but it will also develop strength and quality of tone:

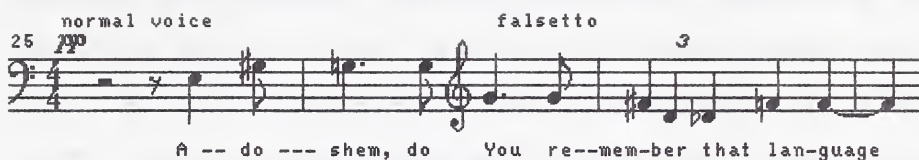


The student should begin this exercise on a comfortably high note in the falsetto register. It should be performed first using the descending five-note passage, then using the descending octave scale. He should transpose the exercise down by semitones until the lowest possible note in the singer's falsetto register has been reached. The first note of the exercise begins with a sharp attack. It is the chest muscles which should be the focal point of this attack and not the vocal cords. A slight glottal stroke accompanies this action; because the voice is very open in this exercise, the cords are not adversely affected by the action of the glottis. Commencing with the oo vowel allows the falsetto to open up and the body to become involved. Once the falsetto voice has been opened through the use of the oo vowel, the singer can proceed to the ah vowel. The ah is a

central vowel, used to determine whether the desired placement, support, and focus have been attained. If more focus is needed the exercise should be repeated using the ee vowel. After this has been done, the singer should return to the ah vowel to determine if better placement, support and focus have been achieved. Ultimately, the ee and oo vowels are used to transfer these elements into the ah vowel. When the desired vocal state has been achieved, the singer should bring the falsetto down into the fundamental voice. This provides the voice with a natural 'ping,' brilliance, and focus.

Falsetto exercises can also be used to help achieve better focus in the singer's lower notes. The lower notes of a baritone or bass voice may become breathy or spread, and may lack placement. The use of a descending glissando from falsetto to the lower register will help to focus the production in this extreme of the register. Beginning on an ee vowel in the falsetto register, the singer carries the falsetto sensation down into the normal voice. After several repetitions of carrying down the ee vowel, the singer then repeats the exercise beginning on an ee vowel, but this time opening to an ah vowel in the lower range. Both glissando exercises should be performed at a comfortable forte dynamic (Harold Wiens, 28 February 1992).

Composers are beginning to write pieces which specify that some sections of their work be performed in falsetto. Canadian composers such as Gerhard Krapf and Alfred Fisher have done so in the last few years. Harold Wiens has fre-



The last phrase of "Zakhor" is to be sung in normal voice. However, since both a great deal of vocalizing in the *falsetto* register and extensive radical shifting from *falsetto* to head register have occurred throughout the piece, Professor Wiens finds it difficult to tune the last note properly while using his normal voice. To overcome this problem, he sings the last note in *falsetto*.

Professor Wiens concludes that the pitch problems he encounters in this piece are a result of the difficulty in making proper adjustments in breath support when shifting from one register to the other. He firmly believes that the main problem with singing *falsetto* in such repertoire is learning to control the support so that the singer does not experience pitch fluctuation when moving from one register to the other.

The *falsetto* register in the male voice must be developed for two primary reasons: to develop a free, easy production in the normal voice registers and to meet the demands of many contemporary composers. Although much of the literature regarding the *falsetto* voice is speculative and much is yet to be discovered about this phenomenon,

certain deductions can be made regarding the validity of *falsetto* development. *Falsetto* exercises, especially those involving *messa di voce*, assist in intrinsic muscle development. As the thyroarytenoid and cricothyroid action in the larynx becomes strengthened and coordinated through vocalizations in the *falsetto* register, the singer is able to bridge the *passaggio* from *falsetto* to head register. Pitch stabilization, when transposing from one register to the other, depends upon intrinsic muscle development and control of the breath support. Bringing the *falsetto* voice down through the modal registers helps to increase support and bring openness, focus, placement and brilliance into the normal voice. This document concludes with a quote from Frederick Husler and Yvonne Rodd-Marling which reinforces the argument for developing the *falsetto* range:

One thing is certain: a voice without *falsetto* is not a singing voice. A voice from which the *falsetto* has disappeared is a ruined voice. There has never been a good singer not gifted with a highly developed *falsetto* function, though he himself may not have been aware of it. Hence the advice given to his *castrati* by Tosi, that great master of the classical age of *bel canto*, to cultivate the *falsetto* with the greatest assiduity.¹³

ENDNOTES

1. Roderick P. Singh, *Anatomy of Hearing and Speech*. (New York: Oxford University Press, 1980), 111.
2. Ibid., 112.
3. Ibid., 113.
4. D. Ralph Appelman, *The Science of Vocal Pedagogy*. Reprint. (Bloomington, NJ: Indiana University Press, 1967), 46.
5. Richard Miller, *The Structure of Singing*. (New York: Schirmer Books, 1986), 256.
6. Ibid., 257.
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